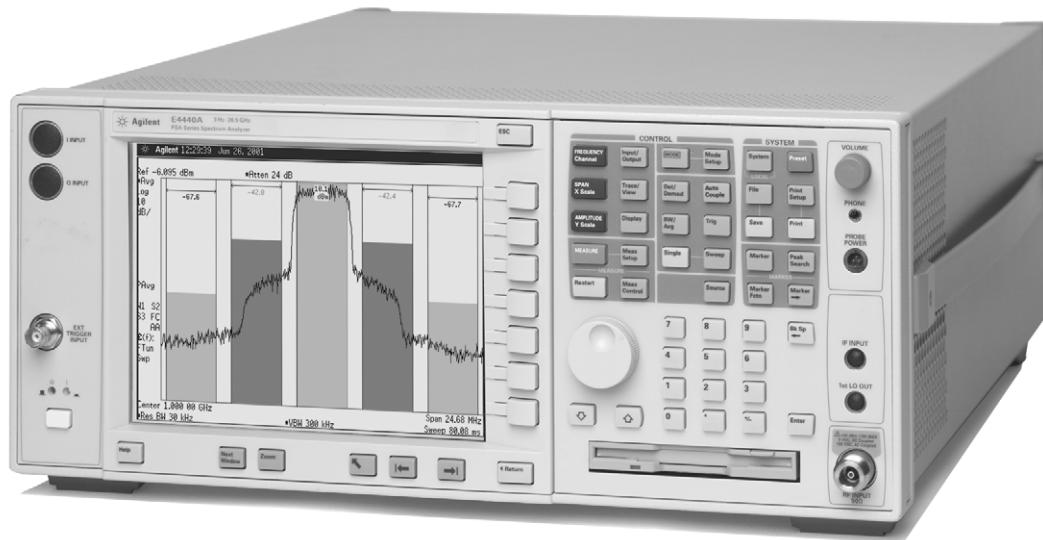


# Agilent PSA Series Spectrum Analyzers

## Data Sheet

- E4443A 3 Hz to 6.7 GHz
- E4445A 3 Hz to 13.2 GHz
- E4440A 3 Hz to 26.5 GHz
- E4446A 3 Hz to 44 GHz
- E4448A 3 Hz to 50 GHz



The Agilent PSA Series offers high-performance spectrum analysis, up to 50 GHz, with powerful one-button measurements, a versatile feature set, and a leading-edge combination of flexibility, speed, accuracy, and dynamic range. From millimeter wave and phase noise measurements to spur searches and modulation analysis, the PSA Series offers unique and comprehensive high-performance solutions to R&D and manufacturing engineers in cellular and emerging wireless communications, aerospace, and defense.



Agilent Technologies

## Table of contents

|  |    |
|--|----|
| Definitions and Conditions .....                           | 3  |
| Specifications for the PSA Series Spectrum Analyzers ..... | 4  |
| Frequency Specifications .....                             | 4  |
| Frequency range .....                                      | 4  |
| Frequency reference .....                                  | 4  |
| Frequency readout accuracy .....                           | 4  |
| Marker frequency counter .....                             | 4  |
| Frequency span .....                                       | 4  |
| Sweep time and triggering .....                            | 4  |
| Sweep (trace) point range .....                            | 4  |
| Gated FFT .....  | 4  |
| Resolution bandwidth (RBW) .....                           | 4  |
| Information bandwidths .....                               | 4  |
| Video bandwidth (VBW) .....                                | 6  |
| Stability .....  | 6  |
| Amplitude Specifications .....                             | 6  |
| Amplitude range .....                                      | 6  |
| Maximum safe input level .....                             | 6  |
| 1dB gain compression (two tone) .....                      | 6  |
| Typical gain compression (two tone) .....                  | 6  |
| Displayed average noise level (DANL) .....                 | 7  |
| Display range .....  | 8  |
| Frequency response .....                                   | 8  |
| Input attenuation switching uncertainty .....              | 8  |
| Absolute amplitude accuracy .....                          | 8  |
| Input voltage standing wave ratio (VSWR) .....             | 8  |
| Resolution bandwidth switching uncertainty .....           | 8  |
| Reference level .....                                      | 8  |
| Display scale switching uncertainty .....                  | 8  |
| Display scale fidelity .....                               | 8  |
| Spurious response .....                                    | 8  |
| Second harmonic distortion (SHI) .....                     | 9  |
| Third-order intermodulation distortion (TOI) .....         | 10 |
| Residual responses .....                                   | 11 |
| Trace detectors .....                                      | 11 |
| Option E444xA-1DS, preamplifier .....                      | 11 |
| Measurement speed .....                                    | 11 |
| Power Suite Measurement Specifications .....               | 12 |
| Channel power .....  | 12 |
| Occupied bandwidth .....                                   | 12 |
| Adjacent channel power .....                               | 12 |
| Multi-carrier power and ACP .....                          | 12 |
| Power statistics CCDF .....                                | 12 |
| Harmonic distortion .....                                  | 12 |
| Intermod (TOI) .....                                       | 12 |
| Burst power .....  | 12 |
| Spurious emission .....                                    | 12 |
| Spectrum emission mask (SEM) .....                         | 12 |
| General Specifications .....                               | 12 |
| Temperature range .....                                    | 12 |
| EMI compatibility .....                                    | 12 |
| Audio noise .....  | 12 |
| Military specification .....                               | 12 |
| Power requirements .....                                   | 12 |
| Weight .....   | 13 |
| Dimensions .....   | 13 |
| Warranty .....   | 13 |
| Calibration cycle .....                                    | 13 |
| Input and Outputs .....                                    | 13 |
| Front panel .....  | 13 |
| Rear panel .....   | 13 |
| Ordering Information .....                                 | 14 |
| PSA Series spectrum analyzer .....                         | 14 |
| Options .....  | 14 |
| Product Literature .....                                   | 15 |
| Warranty and Contact Information .....                     | 16 |

## Definitions and Conditions

Specifications describe the performance of parameters covered by the product warranty and apply over 0 to 55 °C unless otherwise noted. Typical describes additional product performance information that is not covered by the product warranty. It is performance beyond specifications that 80 percent of the units exhibit with a 95 percent confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.

Nominal values indicate expected performance, or describe product performance that is useful in the application of the product, but is not covered by the product warranty.

The analyzer will meet its specifications when:

- stored a minimum of two hours within the operating temperature range and turned on for at least 30 minutes with **Auto Align On** selected.
- the instrument is within its one year calibration cycle.
- **Align All Now** has been performed within the past 24 hours or when the temperature changes 3 °C.
- the instrument is under auto couple control, except that Auto Sweep Time = Accy.
- DC coupling applied if center frequency is < 20 MHz.

This PSA Series data sheet is a summary of the complete specifications and conditions, which are available in the *PSA Series Spectrum Analyzers Specification Guide*.

The *PSA Series Spectrum Analyzers Specification Guide* can be obtained on the web through:

[www.agilent.com/find/psa](http://www.agilent.com/find/psa)

Then follow this selection process:

- Select “Manuals, Guides & Services Notes” from “In the Library”.
- Select “PSA Series Spectrum Analyzers Specifications Guide”.
- Download specifications guide.

## Frequency Specifications

### Frequency range

|        |              |                    |
|--------|--------------|--------------------|
| E4443A | (DC coupled) | 3 Hz to 6.7 GHz    |
|        | (AC coupled) | 10 MHz to 6.7 GHz  |
| E4445A | (DC coupled) | 3 Hz to 13.2 GHz   |
|        | (AC coupled) | 10 MHz to 13.2 GHz |
| E4440A | (DC coupled) | 3 Hz to 26.5 GHz   |
|        | (AC coupled) | 10 MHz to 26.5 GHz |
| E4446A | (DC coupled) | 3 Hz to 44 GHz     |
| E4448A | (DC coupled) | 3 Hz to 50 GHz     |

### Band Harmonic mixing mode (N)

|   |    |                       |
|---|----|-----------------------|
| 0 | 1– | 3 Hz to 3 GHz         |
| 1 | 1– | 2.85 GHz to 6.6 GHz   |
| 2 | 2– | 6.2 GHz to 13.2 GHz   |
| 3 | 4– | 12.8 GHz to 19.2 GHz  |
| 4 | 4– | 18.7 GHz to 26.8 GHz  |
| 5 | 4+ | 26.4 GHz to 31.15 GHz |
| 6 | 8– | 31.0 GHz to 50.0 GHz  |

### Frequency reference

|                       |   |
|-----------------------|---|
| Accuracy              | $\pm [(\text{time since last adjustment} \times \text{aging rate}) + \text{temperature stability} + \text{calibration accuracy}]$ |
| Aging rate            | $\pm 1 \times 10^{-7} / \text{year}$  |
| Temperature stability |   |
| 20 °C to 30 °C        | $\pm 1 \times 10^{-8}$  |
| 0 °C to 55 °C         | $\pm 5 \times 10^{-8}$  |
| Calibration accuracy  | $\pm 7 \times 10^{-8}$  |

Example frequency reference accuracy 1 year after last adjustment:

$$= \pm(1 \times 1 \times 10^{-7} + 1 \times 10^{-8} + 7 \times 10^{-8}) \\ = \pm 1.8 \times 10^{-7}$$

### Frequency readout accuracy (start, stop, center, marker)

$\pm (\text{marker frequency} \times \text{frequency reference accuracy} + 0.25 \text{ percent} \times \text{span} + 5 \text{ percent} \times \text{RBW} + 2 \text{ Hz} + 0.5 \times \text{horizontal resolution}^*)$

\*Horizontal resolution is span/(sweep points – 1)

### Marker frequency counter

|                        |   |
|------------------------|---|
| Accuracy               | $\pm (\text{marker frequency} \times \text{frequency reference accuracy} + 0.100 \text{ Hz})$ |
| Delta counter accuracy | $\pm (\text{delta frequency} \times \text{frequency reference accuracy} + 0.141 \text{ Hz})$  |
| Counter resolution     | 0.001 Hz  |

### Frequency span (FFT and swept mode)

|            |  |
|------------|--|
| Range      | 0 Hz (zero span), 10 Hz to maximum frequency of model                                    |
| Resolution | 2 Hz   |
| Accuracy   | $\pm [0.2 \text{ percent} \times \text{span} + \text{span} / (\text{sweep points} - 1)]$ |

### Sweep time and triggering

|                     |  |  |
|---------------------|--|--|
| Range:              |  |  |
| Span = 0 Hz         | 1 µs to 6000 s   |  |
| Span ≥ 10 Hz        | 1 ms to 2000 s   |  |
| Accuracy            |  |  |
| Span ≥ 10 Hz, sweep | ±0.01% nominal   |  |
| Span ≥ 10 Hz, FFT   | ±40% nominal   |  |
| Span = 0 Hz         | ±0.01% nominal   |  |
| Trigger             | Free run, line, video, RF burst, external front, external rear |  |
| Trigger delay       |  |  |
| Span = 0 Hz, or FFT | -150 ms to +500 ms   |  |
| Span ≥ 10 Hz, swept | 1 µs to 500 ms   |  |
| Resolution          | 0.1 µs   |  |

### Sweep (trace) point range

|              |             |
|--------------|-------------|
| Span = 0 Hz  | 2 to 8192   |
| Span ≥ 10 Hz | 101 to 8192 |

### Gated FFT

|                  |                                      |
|------------------|--------------------------------------|
| Maximum span     | 10 MHz                               |
| Delay range      | -150 to +500 ms                      |
| Delay resolution | 100 ns or 4 digits whichever is more |
| Gate duration    | 1.83/RBW ±2% nominal                 |

### Resolution bandwidth (RBW)

|                            |   |
|----------------------------|---|
| Range (-3.01 dB bandwidth) | 1 Hz to 3 MHz (10% steps), 4, 5, 6, 8 MHz |
|----------------------------|---|

Bandwidth accuracy (power):

|                                 |                   |
|---------------------------------|-------------------|
| RBW range                       |                   |
| 1 Hz to 51 kHz                  | ±0.5% (±0.022 dB) |
| 56 kHz to 75 kHz                | ±1.0% (±0.044 dB) |
| 82 kHz to 330 kHz               | ±0.5% (±0.022 dB) |
| 360 kHz to 1.2 MHz (< 3 GHz CF) | ±1.0% (±0.044 dB) |
| 1.3 MHz to 2.0 MHz (< 3 GHz CF) | ±0.07 dB nominal  |
| 2.2 MHz to 6.0 MHz (< 3 GHz CF) | ±0.02 dB nominal  |

Bandwidth accuracy (-3.01 dB):

|                    |              |
|--------------------|--------------|
| RBW range          |              |
| 8 MHz (< 3 GHz CF) | ±15% nominal |

|                            |               |
|----------------------------|---------------|
| Selectivity (-60 dB/-3 dB) | 4.1:1 nominal |
|----------------------------|---------------|

### Information bandwidths

|                   |        |
|-------------------|--------|
| Maximum FFT width | 10 MHz |
|-------------------|--------|

|   |        |
|---|--------|
| I/Q waveform digital output bandwidth (Option E444xA-B7J) | 10 MHz |
|---|--------|

321.4 MHz IF output:

|                 |                      |
|-----------------|----------------------|
| -1 dB bandwidth | 20 to 30 MHz nominal |
| -3 dB bandwidth | 30 to 60 MHz nominal |

70 MHz IF output (Option E444xA-H70):

|                 |                      |
|-----------------|----------------------|
| -1 dB bandwidth | 20 to 30 MHz nominal |
| -3 dB bandwidth | 30 to 60 MHz nominal |

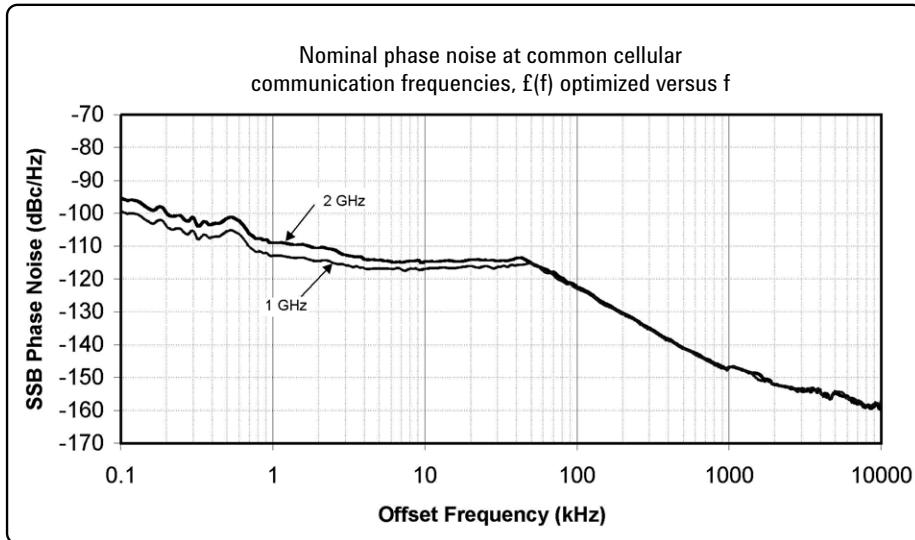


Figure 1. Nominal phase noise at common cellular frequencies

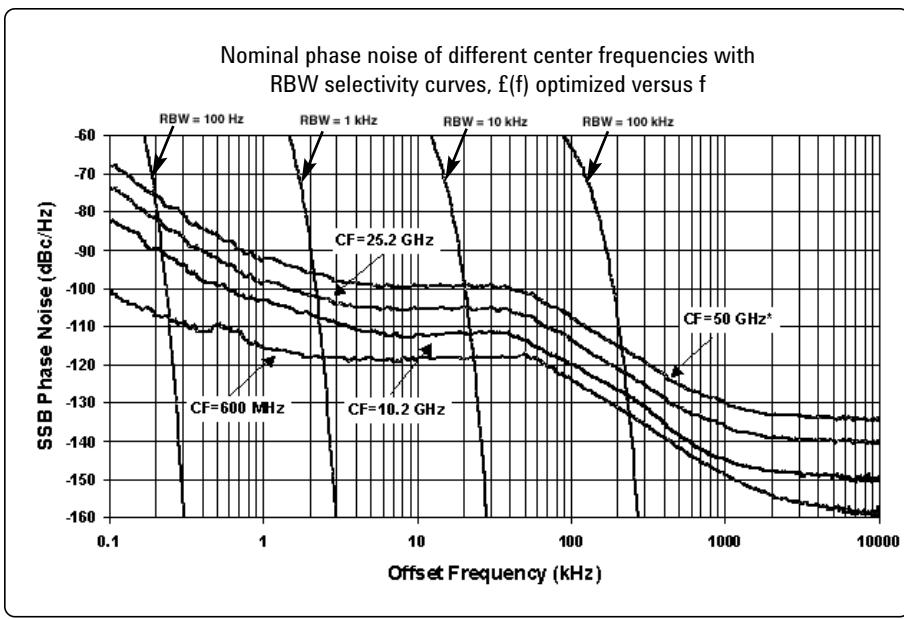


Figure 2. Nominal phase noise at various center frequencies

## Video bandwidth (VBW)

|          |  |
|----------|--|
| Range    | 1 Hz to 3 MHz (10% steps),<br>4, 5, 6, 8 MHz and wide open |
| Accuracy | ± 6% nominal   |

## Stability

Noise sidebands (20 °C to 30 °C, CF = 1 GHz)

| Offset  | Specification | Typical                              |
|---------|---------------|--------------------------------------|
| 100 Hz  | –91 dBc/Hz    | –97 dBc/Hz                           |
| 1 kHz   | –103 dBc/Hz   | –107 dBc/Hz                          |
| 10 kHz  | –114 dBc/Hz   | –117 dBc/Hz                          |
| 30 kHz  | –114 dBc/Hz   | –117 dBc/Hz                          |
| 100 kHz | –120 dBc/Hz   | –123 dBc/Hz                          |
| 1 MHz   | –144 dBc/Hz   | –146 dBc/Hz                          |
|         |               | –148 dBc/Hz nominal                  |
| 6 MHz   | –151 dBc/Hz   | –152 dBc/Hz<br>–156 dBc/Hz nominal   |
| 10 MHz  | –151 dBc/Hz   | –152 dBc/Hz<br>–157.5 dBc/Hz nominal |

Residual FM: < (1 Hz X N) p-p in 1 s

See frequency range for N (harmonic number)

## Amplitude Specifications

### Amplitude range

|                        |  |
|------------------------|--|
| Measurement range      | Displayed average noise level (DANL) to maximum safe input level |
| Input attenuator range | 0 to 70 dB in 2 dB steps   |

### Maximum safe input level

|   |  |
|---|--|
| Average total power                         | +30 dBm (1 W)  |
| Preamp (Option E444xA-1DS)                  | +25 dBm  |
| Peak pulse power                            | < 10 µs pulse width, < 1% duty cycle and input attenuation ≥ 30 dB |
| DC volts:                                   | +50 dBm (100 W)  |
| DC coupled                                  | < ±0.2 Vdc   |
| AC coupled<br>(E4443A, E4445A, E4440A only) | ±100 Vdc   |

### 1 dB gain compression (two-tone)

| Total power at input mixer |        |                |
|----------------------------|--------|----------------|
| 20 MHz to 200 MHz          | 0 dBm  | +3 dBm nominal |
| 200 MHz to 3 GHz           | +3 dBm | +7 dBm nominal |
| 3 GHz to 6.6 GHz           | +3 dBm | +4 dBm nominal |
| 6.6 GHz to 26.5 GHz        | –2 dBm | 0 dBm nominal  |
| 26.5 GHz to 50 GHz         |        | 0 dBm nominal  |

### Preamp on (Option E444xA-1DS)

|                   |                 |
|-------------------|-----------------|
| 10 MHz to 200 MHz | –30 dBm nominal |
| 200 MHz to 3 GHz  | –25 dBm nominal |

### Typical gain compression (two-tone)

| Mixer level         | Compression |
|---------------------|-------------|
| 20 MHz to 200 MHz   | < 0.5 dB    |
| 200 MHz to 6.6 GHz  | < 0.5 dB    |
| 6.6 GHz to 26.5 GHz | < 0.4 dB    |

## Displayed Average Noise Level (DANL)

(Input terminated, sample or average detector, averaging type = Log, 20 to 30 °C)

|  | <b>Zero span and swept<br/>normalized to 1 Hz RBW<br/>and 0 dB attenuation</b> | <b>Zero span and swept<br/>normalized to 1 Hz RBW<br/>and 0 dB attenuation<br/>(typical)</b> | <b>FFT only<br/>actual 1 Hz RBW<br/>0 dB attenuation</b> |
|--|--|--|--|
| <b>E4443A/E4445A/E4440A</b>              |  |  |  |
| 3 Hz to 1 kHz                            | —  | -110 dBm nominal   | —  |
| 1 kHz to 10 kHz                          | —  | -130 dBm nominal   | —  |
| 10 kHz to 100 kHz                        | -135 dBm   | -142 dBm   | -135 dBm   |
| 100 kHz to 1 MHz                         | -145 dBm   | -149 dBm   | -145 dBm   |
| 1 MHz to 10 MHz                          | -150 dBm   | -153 dBm   | -150 dBm   |
| 10 MHz to 1.2 GHz                        | -155 dBm   | -156 dBm   | -154 dBm   |
| 1.2 GHz to 2.5 GHz                       | -154 dBm   | -155 dBm   | -153 dBm   |
| 2.5 GHz to 3.0 GHz                       | -153 dBm   | -154 dBm   | -152 dBm   |
| 3 GHz to 6.6 GHz                         | -152 dBm   | -153 dBm   | -151 dBm   |
| 6.6 GHz to 13.2 GHz                      | -150 dBm   | -152 dBm   | -149 dBm   |
| 13.2 GHz to 20 GHz                       | -147 dBm   | -149 dBm   | -146 dBm   |
| 20 GHz to 26.5 GHz                       | -143 dBm   | -145 dBm   | -143 dBm   |
| <b>Preamp ON (Option E4443/5/0A-1DS)</b> |  |  |  |
| 100 kHz to 200 kHz                       | -161 dBm   | -164 dBm   | -160 dBm   |
| 200 kHz to 500 kHz                       | -164 dBm   | -167 dBm   | -163 dBm   |
| 500 kHz to 10 MHz                        | -166 dBm   | -168 dBm   | -165 dBm   |
| 10 MHz to 1.1 GHz                        | -169 dBm   | -170 dBm   | -168 dBm   |
| 1.1 GHz to 2.5 GHz                       | -168 dBm   | -169 dBm   | -167 dBm   |
| 2.5 GHz to 3.0 GHz                       | -166 dBm   | -167 dBm   | -165 dBm   |
| <b>E4446A/E4448A</b>                     |  |  |  |
| 3 Hz to 1 kHz                            | —  | -110 dBm nominal   | —  |
| 1 kHz to 10 kHz                          | —  | -130 dBm nominal   | —  |
| 10 kHz to 100 kHz                        | -140 dBm   | -143 dBm   | -140 dBm   |
| 100 kHz to 1 MHz                         | -145 dBm   | -150 dBm   | -145 dBm   |
| 1 MHz to 10 MHz                          | -150 dBm   | -155 dBm   | -150 dBm   |
| 10 MHz to 1.2 GHz                        | -154 dBm   | -155 dBm   | -153 dBm   |
| 1.2 GHz to 2.2 GHz                       | -153 dBm   | -154 dBm   | -152 dBm   |
| 2.2 GHz to 3 GHz                         | -152 dBm   | -153 dBm   | -151 dBm   |
| 3 GHz to 6.6 GHz                         | -151 dBm   | -152 dBm   | -150 dBm   |
| 6.6 GHz to 13.2 GHz                      | -146 dBm   | -149 dBm   | -146 dBm   |
| 13.2 GHz to 20 GHz                       | -145 dBm   | -147 dBm   | -144 dBm   |
| 20 GHz to 22.5 GHz                       | -143 dBm   | -146 dBm   | -143 dBm   |
| 22.5 GHz to 26.8 GHz                     | -140 dBm   | -144 dBm   | -140 dBm   |
| 26.8 GHz to 31.15 GHz                    | -142 dBm   | -145 dBm   | -141 dBm   |
| 31.15 GHz to 36 GHz                      | -134 dBm   | -136 dBm   | -133 dBm   |
| 36 GHz to 38 GHz                         | -129 dBm   | -132 dBm   | -129 dBm   |
| 38 GHz to 44 GHz                         | -131 dBm   | -134 dBm   | -131 dBm   |
| 44 GHz to 49 GHz                         | -128 dBm   | -131 dBm   | -127 dBm   |
| 49 GHz to 50 GHz                         | -127 dBm   | -130 dBm   | -126 dBm   |
| <b>Preamp ON (Option E4446/8A-1DS)</b>   |  |  |  |
| 100 kHz to 200 kHz                       | -160 dBm   | -164 dBm   | -159 dBm   |
| 200 kHz to 500 kHz                       | -163 dBm   | -167 dBm   | -162 dBm   |
| 500 kHz to 10 MHz                        | -164 dBm   | -168 dBm   | -163 dBm   |
| 1 MHz to 10 MHz                          | -167 dBm   | -169 dBm   | -166 dBm   |
| 10 MHz to 1.2 GHz                        | -167 dBm   | -169 dBm   | -167 dBm   |
| 1.2 GHz to 2.2 GHz                       | -166 dBm   | -168 dBm   | -166 dBm   |
| 2.2 GHz to 3.0 GHz                       | -164 dBm   | -166 dBm   | -164 dBm   |

## Display range

|              |   |
|--------------|---|
| Log scale    | 0.1 to 1 dB/division in 0.1 dB steps<br>1 to 20 dB/division in 1 dB steps<br>(10 display divisions) |
| Linear scale | 10 divisions  |
| Scale units  | dBm, dBmV, dBuV, V, and W   |

## Frequency response

(10 dB input attenuation, 20 to 30 °C, preselector centering applied)

### E443A/E4445A/E4440A

|                    |          |                    |
|--------------------|----------|--------------------|
| 3 Hz to 3 GHz      | ±0.38 dB | (±0.11 dB typical) |
| 3 GHz to 6.6 GHz   | ±1.50 dB | (±0.6 dB typical)  |
| 6.6 GHz to 22 GHz  | ±2.00 dB | (±1.0 dB typical)  |
| 22 GHz to 26.5 GHz | ±2.50 dB | (±1.3 dB typical)  |

### E4446A/E4448A

|                       |          |                    |
|-----------------------|----------|--------------------|
| 3 Hz to 3 GHz         | ±0.38 dB | (±0.15 dB typical) |
| 3 GHz to 6.6 GHz      | ±1.50 dB | (±0.6 dB typical)  |
| 6.6 GHz to 22 GHz     | ±2.00 dB | (±1.2 dB typical)  |
| 22 GHz to 26.8 GHz    | ±2.50 dB | (±1.3 dB typical)  |
| 26.4 GHz to 31.15 GHz | ±1.75 dB | (±0.6 dB typical)  |
| 31.15 GHz to 50 GHz   | ±2.50 dB | (±1.0 dB typical)  |

## Frequency response at attenuation ≠ 10 dB

(Atten = 20, 30, or 40 dB)

|                   |          |
|-------------------|----------|
| 10 MHz to 2.2 GHz | ±0.53 dB |
| 2.2 GHz to 3 GHz  | ±0.69 dB |

### Preamp on (Option E444xA-1DS). (for all models)

|                  |          |                      |
|------------------|----------|----------------------|
| 100 kHz to 3 GHz | ±0.70 dB | < (±0.30 dB typical) |
|------------------|----------|----------------------|

## Input attenuation switching uncertainty

(Attenuator setting ≥ 2 dB)

|                      |                 |
|----------------------|-----------------|
| At 50 MHz            | ±0.18 dB        |
| 3 Hz to 3 GHz        | ±0.3 dB nominal |
| 3 GHz to 13.2 GHz    | ±0.5 dB nominal |
| 13.2 GHz to 26.5 GHz | ±0.7 dB nominal |
| 26.5 GHz to 50 GHz   | ±1.0 dB nominal |

## Absolute amplitude accuracy

|   |   |
|---|---|
| (10 dB attenuation, 20 to 30 °C, 10 Hz ≤ RBW ≤ 1 MHz, input signal –10 to –50 dBm, all settings auto-coupled except Auto Swp Time = Accy, any reference level, any scale) |   |
| At 50 MHz   | ±0.24 dB (±0.06 dB typical)   |
| At all frequencies  | ± (0.24 dB + frequency response)<br>± (0.06 dB+ frequency response) typical |
| 3 Hz to 3 GHz<br>(95% confidence)   | ±0.24 dB  |

|                               |   |
|-------------------------------|---|
| Preamp on (Option E444xA-1DS) | ± (0.36 dB + frequency response)<br>± (0.09 dB+ frequency response) typical |
|-------------------------------|---|

## Input voltage standing wave ratio (VSWR)

|  |                 |
|--|-----------------|
| (≥ 8 dB input attenuation)                           |                 |
| 50 MHz to 3 GHz                                      | < 1.2:1 nominal |
| 3 GHz to 18 GHz                                      | < 1.6:1 nominal |
| 18 GHz to 26.5 GHz                                   | < 1.9:1 nominal |
| 26.5 GHz to 50 GHz                                   | < 1.6:1 nominal |
| Preamp on (50 MHz to 3 GHz)<br>(≥ 10 dB attenuation) | < 1.2:1 nominal |

## Resolution bandwidth switching uncertainty

(referenced to 30 kHz RBW)

|                      |          |
|----------------------|----------|
| 1 Hz to 1 MHz RBW    | ±0.03 dB |
| 1.1 MHz to 3 MHz RBW | ±0.05 dB |
| 4, 5, 6, 8 MHz RBW   | ±1.0 dB  |

## Reference level

|              |                                      |
|--------------|--------------------------------------|
| Range:       |                                      |
| Log scale    | -170 dBm to +30 dBm in 0.01 dB steps |
| Linear scale | 707 pV to 7.07 V in 0.1% steps       |
| Accuracy     | 0 dB                                 |

## Display scale switching uncertainty

|                                  |      |
|----------------------------------|------|
| Switching between linear and log | 0 dB |
| Log scale/div switching          | 0 dB |

## Display scale fidelity

|                                 |                |
|---------------------------------|----------------|
| ≤ –20 dBm input mixer level     | ±0.07 dB total |
| –20 dBm < mixer level ≤ –10 dBm | ±0.13 dB total |

## Spurious response (mixer level = –40 dBm)

|                         |                              |
|-------------------------|------------------------------|
| General spurious:       |                              |
| f < 10 MHz from carrier | (–73 + 20 log N) dBc         |
| f ≥ 10 MHz from carrier | (–80 + 20 log N) dBc         |
|                         | (–90 + 20 log N) dBc typical |

See frequency range for N

## Second harmonic distortion (SHI)

| E4443A, E4445A, E4440A                        | Distortion (dBc) | SHI (dBm) |
|---|------------------|-----------|
| 10 MHz to 400 MHz<br>(-40 dBm mixer level)    | -82              | +42       |
| 400 MHz to 1.25 GHz<br>(-40 dBm mixer level)  | -92              | +52       |
| 1.25 GHz to 1.5 GHz<br>(-40 dBm mixer level)  | -82              | +42       |
| 1.5 GHz to 2.0 GHz<br>(-10 dBm mixer level)   | -90              | +80       |
| 2.0 GHz to 13.25 GHz<br>(-10 dBm mixer level) | -100             | +90       |

## E4446A, E4448A

| Distortion (dBc)                               | SHI (dBm)   |
|--|-------------|
| 10 MHz to 400 MHz<br>(-40 dBm mixer level)     | +42         |
| 400 MHz to 1.25 GHz<br>(-40 dBm mixer level)   | +51         |
| 1.25 GHz to 1.5 GHz<br>(-40 dBm mixer level)   | +41         |
| 1.5 GHz to 2.0 GHz<br>(-10 dBm mixer level)    | +80         |
| 2.0 GHz to 3.25 GHz<br>(-10 dBm mixer level)   | +84         |
| 3.25 GHz to 13.25 GHz<br>(-10 dBm mixer level) | +86         |
| 13.25 GHz to 25 GHz<br>(-10 dBm mixer level)   | +90 nominal |
| 100 nominal                                    | +90 nominal |

Preamp on (Option E444xA-1DS), (for all models)  
(input preamp level = -45 dBm)

10 MHz to 1.5 GHz      -60 nominal      +15 nominal

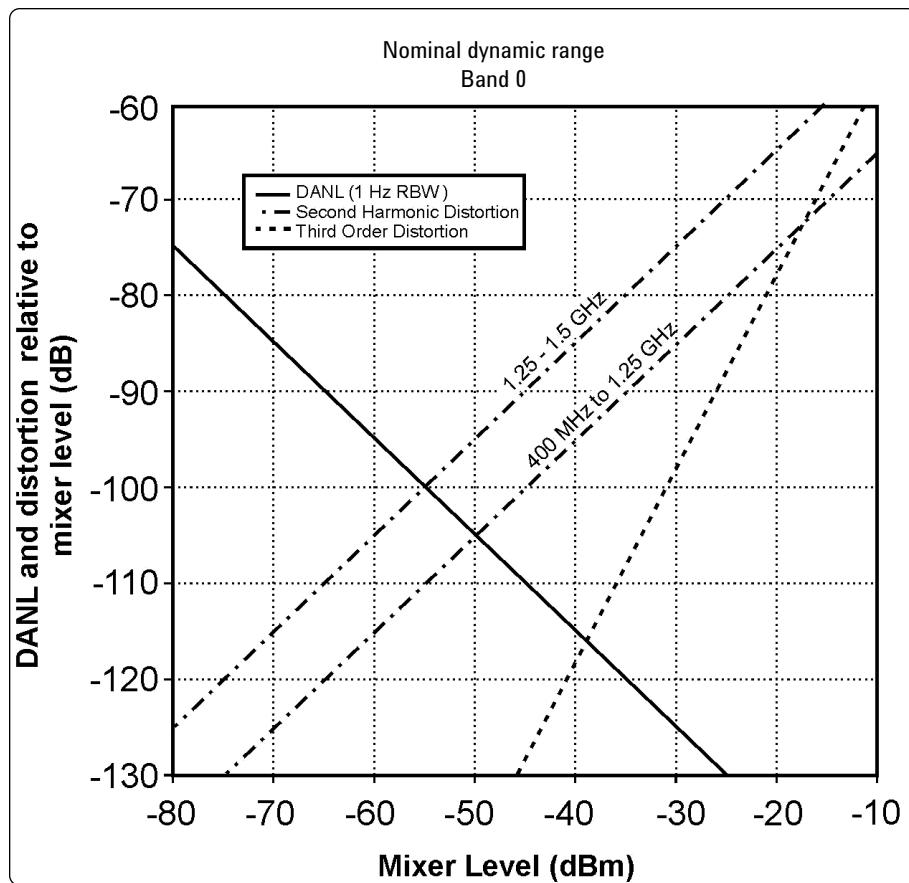


Figure 3. Nominal dynamic range - Band 0, for second and third order distortion,  
E4443A, E4445A, and E4440A - 3 Hz to 3 GHz

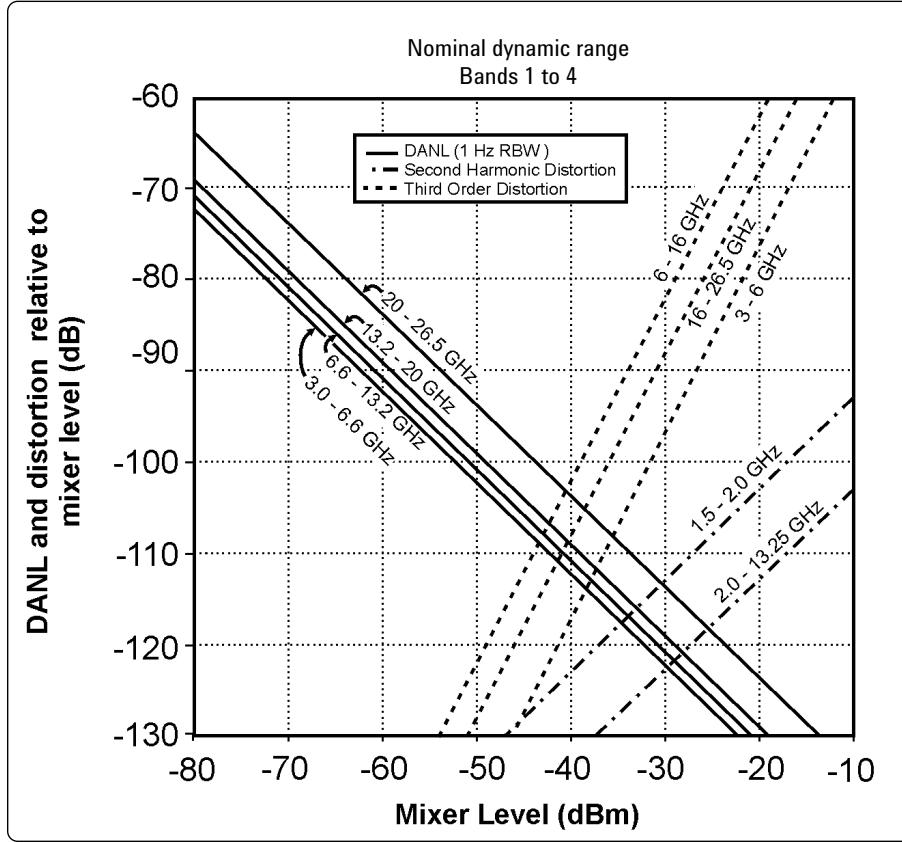


Figure 4. Nominal dynamic range – Bands 1 to 4, second and third order distortion, E4443A, E4445A, E4440A - 3 GHz to 26.5 GHz

### Third-order intermodulation distortion (TOI)

(two  $-30$  dBm tones at input mixer with tone separation  
 $> 15$  kHz,  $20$  to  $30$  °C)

#### E4443A/E4445A/E4440A

|                    | <b>Distortion (dBc)</b> | <b>TOI (dBm)</b>  |
|--------------------|-------------------------|-------------------|
| 10 MHz to 100 MHz  | -88                     | +14 (+17 typical) |
| 100 MHz to 400 MHz | -90                     | +15 (+18 typical) |
| 400 MHz to 1.7 GHz | -92                     | +16 (+19 typical) |
| 1.7 GHz to 3.0 GHz | -94                     | +17 (+19 typical) |
| 3.0 GHz to 6.0 GHz | -90                     | +15 (+18 typical) |
| 6.0 GHz to 16 GHz  | -76                     | +8 (+11 typical)  |
| 16 GHz to 26.5 GHz | -84                     | +12 (+14 typical) |

#### E4446A/E4448A

| <b>Distortion (dBc)</b>  | <b>TOI (dBm)</b> |
|--|------------------|
| 10 MHz to 100 MHz  | -90              |
| 100 MHz to 400 MHz   | -92              |
| 400 MHz to 1.7 GHz   | -94              |
| 1.7 GHz to 3.0 GHz   | -96              |
| 3.0 GHz to 6.0 GHz   | -92              |
| 6.0 GHz to 16 GHz  | -84              |
| 16.0 GHz to 26.5 GHz   | -84              |
| 26.5 GHz to 50 GHz   | -85 nominal      |
| Preamp on (Option E444xA-1DS), (for all models, two $-45$ dBm tones at preamp input) |                  |
| 10 MHz to 500 MHz  | -15 nominal      |
| 500 MHz to 3 GHz   | -13 nominal      |

## Residual responses

|                                       |                  |
|---------------------------------------|------------------|
| Input terminated and 0 dB attenuation |                  |
| 200 kHz to 6.6 GHz                    | -100 dBm         |
| 6.6 GHz to 26.8 GHz                   | -100 dBm nominal |
| 26.8 GHz to 50 GHz                    | -90 dBm nominal  |

## Trace detectors

Normal, peak, sample, negative peak, log power average, RMS average, and voltage average

## Option E444xA-1DS, preamplifier

|                 |                  |
|-----------------|------------------|
| Frequency range | 100 kHz to 3 GHz |
| Gain            | 28 dB nominal    |
| Noise figure    | 7 dB nominal     |

## Measurement speed

|   |                            |
|---|----------------------------|
| Local measurement and display update rate | $\geq 50/\text{s}$ nominal |
| Remote measurement and GPIB transfer rate |                            |
| 101 sweep points                          | $\geq 45/\text{s}$ nominal |
| 401 sweep points                          | $\geq 30/\text{s}$ nominal |
| 601 sweep points                          | $\geq 25/\text{s}$ nominal |

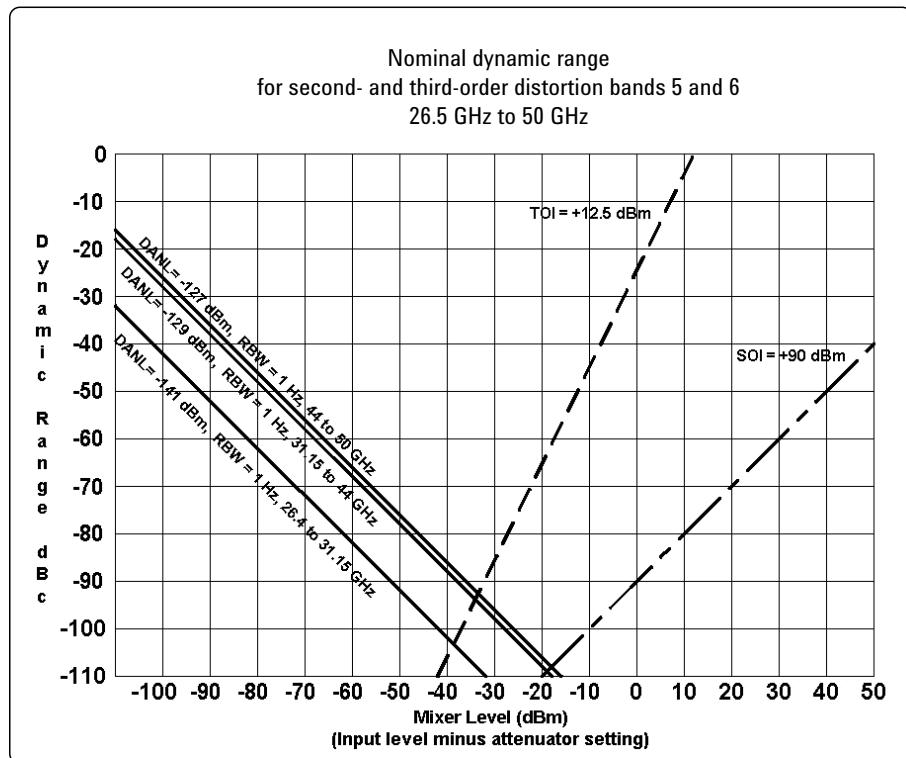


Figure 5. Nominal dynamic range – Bands 5 to 6, E4446A and E4448A - 26.4 GHz to 50 GHz

# Power Suite Measurement Specifications

## Channel power

Amplitude accuracy, W-CDMA or IS95  
(20 to 30 °C, mixer level < -20 dBm) ±0.68 dB (±0.18 dB typical)

## Occupied bandwidth

Frequency accuracy ± [span/600] nominal

## Adjacent channel power

Accuracy, W-CDMA (ACLR) (at specific mixer levels and ACLR ranges):

|                               | <b>Adjacent</b> | <b>Alternate</b> |
|-------------------------------|-----------------|------------------|
| MS                            | ±0.12 dB        | ±0.17 dB         |
| BTS                           | ±0.22 dB        | ±0.22 dB         |
| Dynamic range (typical):      |                 |                  |
| w/o noise correction          | -74.5 dB        | -82 dB           |
| w/noise correction            | -81 dB          | -88 dB           |
| Offset channel pairs measured | 1 to 6          |                  |

## Multi-carrier power and ACP

ACPR dynamic range, W-CDMA (5 MHz offset, RRC weighted,  
3.84 MHz noise bandwidth):

|               |                |
|---------------|----------------|
| Two carriers  | -70 dB nominal |
| Four carriers | -68 dB nominal |

ACPR accuracy (two carriers,  
5 MHz offset, -48 dBc ACPR) ±0.38 dB nominal

Multiple number of  
carriers measured Up to 12

## Power statistics CCDF

Histogram resolution 0.1 dB

## Harmonic distortion

Maximum harmonic number 10<sup>th</sup>  
Results Fundamental power (dBm), relative  
harmonics power (dBc), total  
harmonic distortion in percent

## Intermod (TOI)

Measure the third-order products and intercepts from two tones

## Burst power

Methods Power above threshold, power  
within burst width  
Results Single burst output power, average  
output power, maximum power,  
minimum power within burst,  
burst width

## Spurious emission

cdma2000 or W-CDMA (1980 MHz region, 1.2 MHz RBW)

Table driven spurious signals; search across regions.

|                        |                               |
|------------------------|-------------------------------|
| Relative dynamic range | 80.6 dB (82.4 dB typical)     |
| Absolute sensitivity   | -89.7 dBm (-91.7 dBm typical) |

## Spectrum emission mask (SEM)

cdma2000 (750 kHz offset):

|  |                               |
|--|-------------------------------|
| Relative dynamic range<br>(30 kHz RBW) | 85.3 dB (88.3 dB typical)     |
| Absolute sensitivity                   | -105.7 dBm (-107 dBm typical) |
| Relative accuracy                      | ±0.09 dB                      |

3GPP W-CDMA (2.515 MHz offset):

|  |                                 |
|--|---------------------------------|
| Relative dynamic range<br>(30 kHz RBW) | 87.3 dB (89.5 dB typical)       |
| Absolute sensitivity                   | -105.7 dBm (-107.7 dBm typical) |
| Relative accuracy                      | ±0.10 dB                        |

## General Specifications

### Temperature range

|           |                  |
|-----------|------------------|
| Operating | 0 °C to +55 °C   |
| Storage   | -40 °C to +75 °C |

### EMI compatibility

- Conducted interference is in compliance with CISPR Pub 11/1990 Group 1 Class A
- Radiated emission is in compliance with CISPR Pub 11/1990 Group 1 Class B

### Audio noise

|          |                          |
|----------|--------------------------|
| ISO 7779 | LNPE < 5.0 BELS at 25 °C |
|----------|--------------------------|

### Military specification

Type tested to environmental specifications MIL-PRF-28800F Class 4

### Power requirements

Voltage and frequency:

|  |
|--|
| 100 to 132 Vrms, 47 to 66 Hz/360 to 440 Hz |
| 195 to 250 Vrms, 47 to 66 Hz               |

Power consumption:

|         |   |
|---------|---|
| On      | < 260 watts, no options<br>(< 450 watts, all options) |
| Standby | < 20 watts  |

## **Weight** (*without options*)

### **E4443A, E4445A, E4440A**

|                       |                        |
|-----------------------|------------------------|
| Net                   | 23 kg (50 lbs) nominal |
| Shipping              | 33 kg (73 lbs) nominal |
| <b>E4446A, E4448A</b> |                        |
| Net                   | 24 kg (53 lbs) nominal |
| Shipping              | 34 kg (76 lbs) nominal |

## **Dimensions**

|        |                  |
|--------|------------------|
| Height | 177 mm (7.0 in)  |
| Width  | 426 mm (16.8 in) |
| Length | 483 mm (19 in)   |

## **Warranty**

The E4440A, E4443A, E4445A, E4446A and E4448A are supplied with a three-year warranty.

## **Calibration cycle**

The recommended calibration cycle is one year. Calibration services are available through Agilent service centers.

## **Input and Outputs**

### **Front panel**

#### **RF input**

|                   |                     |
|-------------------|---------------------|
| Connector:        |                     |
| E4443A/E4445A     | Type-N female, 50 Ω |
| E4440A            | Type-N female, 50 Ω |
| Option E4440A-BAB | APC 3.5 male        |
| E4446A/E4448A     | 2.4 mm male, 50 Ω   |

#### **Probe power**

|                           |   |
|---------------------------|---|
| Voltage/current (nominal) | +15 Vdc, ±7% at 150 mA max<br>–12.6 Vdc, ±10% at 150 mA max GND |
|---------------------------|---|

#### **Headphone**

Reserved for future applications

#### **Ext trigger input**

|               |                 |
|---------------|-----------------|
| Connector     | BNC female      |
| Impedance     | 10 kΩ nominal   |
| Trigger level | 5 V TTL nominal |

## **Rear panel**

### **10 MHz OUT (switched)**

|                    |  |
|--------------------|--|
| Connector          | BNC female, 50 Ω                                 |
| Output amplitude   | ≥ 0 dBm nominal                                  |
| Frequency accuracy | 10 MHz ± (10 MHz x frequency reference accuracy) |

#### **Ext Ref In**

|                       |  |
|-----------------------|--|
| Connector             | BNC female, 50 Ω   |
| Input amplitude range | –5 to +10 dBm nominal  |
| Input frequency       | 1 to 30 MHz nominal  |
| Frequency lock range  | ± 5 × 10 <sup>-6</sup> of specified external reference input frequency |

#### **Trigger in**

|                         |                 |
|-------------------------|-----------------|
| Connector               | BNC female      |
| External trigger input: |                 |
| Impedance               | > 10 kΩ nominal |
| Level                   | 5 V TTL nominal |

### **Trigger 1 and Trigger 2 outputs**

|                   |                                  |
|-------------------|----------------------------------|
| Connector         | BNC female                       |
| Trigger 1 output: | HSPW (high = sweeping)           |
| Impedance         | 50 Ω nominal                     |
| Level             | 5 V TTL                          |
| Trigger 2 output  | Reserved for future applications |

#### **Monitor output**

|            |  |
|------------|--|
| Connector  | VGA compatible, 15-pin mini D-SUB                                    |
| Format     | VGA (31.5 kHz horizontal, 60 Hz vertical sync rates, non-interlaced) |
|            | Analog RGB   |
| Resolution | 640 X 480  |

#### **Noise source drive output**

|                |                              |
|----------------|------------------------------|
| Connector      | BNC female                   |
| Output voltage |                              |
| On             | 28.0 ± 0.1 V (60 mA maximum) |
| Off            | < 1 V                        |

#### **Remote programming**

|                            |  |
|----------------------------|--|
| GPIB interface:            |  |
| Connector                  | IEEE-488 bus connector   |
| GPIB codes                 | SH1, AH1, T6, SR1, RL1, PPO, DC1, C1, C2, C3, and C28, DT1, L4, C0 |
| Serial interface connector | 9-pin D-SUB male (factory use only)                                |
| LAN TCP/IP interface       | RJ45 EtherTwist  |

#### **Parallel printer interface connector**

25-pin D-SUB female

#### **321.4 MHz IF output**

|                 |                          |
|-----------------|--------------------------|
| Connector       | SMA female, 50 Ω nominal |
| Frequency       | 321.4 MHz nominal        |
| Conversion gain | +2 to +4 dB nominal      |

# Ordering Information

## PSA Series spectrum analyzer

|        |                  |
|--------|------------------|
| E4443A | 3 Hz to 6.7 GHz  |
| E4445A | 3 Hz to 13.2 GHz |
| E4440A | 3 Hz to 26.5 GHz |
| E4446A | 3 Hz to 44 GHz   |
| E4448A | 3 Hz to 50 GHz   |

## Options

To add options to a product, use the following ordering scheme:

|                 |                              |
|-----------------|------------------------------|
| Model           | E444xA (x = 0, 3, 5, 6 or 8) |
| Example options | E4440A-B7J<br>E4448A-1DS     |

## Digital demodulation hardware

|            |   |
|------------|---|
| E444xA-B7J | Digital demodulation hardware (required for digital demodulation measurement personalities) |
|------------|---|

## Digital demodulation measurements

|            |                                     |
|------------|-------------------------------------|
| E444xA-BAF | W-CDMA measurement personality      |
| E444xA-202 | GSM w/ EDGE measurement personality |
| E444xA-B78 | cdma2000 measurement personality    |
| E444xA-204 | 1xEV-DO measurement personality     |
| E444xA-BAC | cdmaOne measurement personality     |
| E444xA-BAE | NADC, PCD measurement personality   |

## General purpose measurements

|            |                                      |
|------------|--------------------------------------|
| E444xA-226 | Phase noise measurement personality  |
| E444xA-219 | Noise figure measurement personality |

## Amplifiers

|            |  |
|------------|--|
| E444xA-1DS | 100 kHz to 3 GHz built-in preamplifier |
|------------|--|

## Inputs and outputs

|            |  |
|------------|--|
| E4440A-BAB | Replaces type "N" input connector with APC 3.5 connector |
|------------|--|

## Connectivity software

|            |                                       |
|------------|---------------------------------------|
| E444xA-230 | BenchLink Web Remote Control Software |
|------------|---------------------------------------|

## Code compatibility

|            |   |
|------------|---|
| E444xA-266 | HP 8566B/8568B code compatibility measurement personality |
|------------|---|

## Accessories

|            |                                   |
|------------|-----------------------------------|
| E444xA-1CM | Rack mount kit                    |
| E444xA-1CN | Front handle kit                  |
| E444xA-1CP | Rack mount with handles           |
| E444xA-1CR | Rack slide kit                    |
| E444xA-045 | Millimeter wave accessory kit     |
| E444xA-0B1 | Extra manual set including CD ROM |

## Warranty and service

For warranty and service of 5 years, please order 60 months of R-51B (quantity = 60). Standard warranty is 36 months.

|       |   |
|-------|---|
| R-51B | Return-to-Agilent warranty and service plan |
|-------|---|

## Calibration<sup>1</sup>

For 3 years, order 36 months of the appropriate calibration plan shown below. For 5 years, specify 60 months.

|            |   |
|------------|---|
| R-50C-001  | Standard calibration                              |
| R-50C-002  | Standards compliant calibration                   |
| E444xA-OBW | Service manual and calibration software           |
| E444xA-UK6 | Commercial calibration certificate with test data |

<sup>1</sup> Options not available in all countries.

## Product Literature

*PSA Series*, brochure, literature number 5980-1283E  
*PSA Series*, data sheet, literature number 5980-1284E  
*Self-Guided Demonstration for Spectrum Analysis*,  
product note, literature number 5988-0735EN

*Phase Noise Measurement Personality*, technical overview,  
literature number 5988-3698EN

*Noise Figure Measurement Personality*, technical overview,  
literature number 5988-7884EN

*W-CDMA Measurement Personality*, technical overview,  
literature number 5988-2388EN

*GSM with EDGE Measurement Personality*,  
technical overview, literature number 5988-2389EN

*cdma2000 Measurement Personality*,  
technical overview, literature number 5988-3694EN

*IxEV-DO Measurement Personality*,  
technical overview, literature number 5988-4828EN

*cdmaOne Measurement Personality*,  
technical overview, literature number 5988-3695EN

*NADC/PDC Measurement Personality*,  
technical overview, literature number 5988-3697EN

*Optimizing Dynamic Range for Distortion Measurements*,  
product note, literature number 5980-3079EN

*PSA Series Amplitude Accuracy*,  
product note, literature number 5980-3080EN

*PSA Series Swept and FFT Analysis*,  
product note, literature number 5980-3081EN

*PSA Series Measurement Innovations and Benefits*,  
product note, literature number 5980-3082EN

*8 Hints for Millimeter Wave Spectrum Measurements*,  
application note, literature number 5988-5680EN

*PSA Series Spectrum Analyzers, Option H70*,  
*70 MHz IF Output*, product overview,  
literature number 5988-5261EN

*PSA Series Spectrum Analyzer Performance Guide*  
*Using 89601A Vector Signal Analysis Software*,  
product note, literature number 5988-5015EN

*89600 Series + PSA, 802.11A and HiperLAN2 ODFM*  
*Measurements*, product note,  
literature number 5988-4094EN

*Selecting the Right Signal Analyzer for Your Needs*,  
selection guide, literature number 5968-3413E

*HP 8566B/68B Programming Code Compatibility for*  
*PSA and ESA-E Series Spectrum Analyzers*, product  
overview, literature number 5988-5808EN

*BenchLink Web Remote Control Software*,  
product overview, literature number 5988-2610EN

*IntuiLink Software*, Data Sheet,  
Literature Number 5980-3115EN

For more information on the PSA Series, please visit:

**[www.agilent.com/find/psa](http://www.agilent.com/find/psa)**

## **Agilent Technologies' Test and Measurement Support, Services, and Assistance**

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

### **Our Promise**

Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

### **Your Advantage**

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and onsite education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.



## **Agilent Email Updates**

**[www.agilent.com/find/emailupdates](http://www.agilent.com/find/emailupdates)**

Get the latest information on the products and applications you select.

### **Agilent T&M Software and Connectivity**

Agilent's Test and Measurement software and connectivity products, solutions and developer network allows you to take time out of connecting your instruments to your computer with tools based on PC standards, so you can focus on your tasks, not on your connections. Visit **[www.agilent.com/find/connectivity](http://www.agilent.com/find/connectivity)** for more information.

**By internet, phone, or fax, get assistance with all your test & measurement needs**

#### **Phone or Fax**

##### **United States:**

(tel) 800 452 4844

##### **Canada:**

(tel) 877 894 4414

(fax) 905 282 6495

##### **China:**

(tel) 800 810 0189

(fax) 800 820 2816

##### **Europe:**

(tel) (31 20) 547 2323

(fax) (31 20) 547 2390

##### **Japan:**

(tel) (81) 426 56 7832

(fax) (81) 426 56 7840

##### **Korea:**

(tel) (82 2) 2004 5004

(fax) (82 2) 2004 5115

##### **Latin America:**

(tel) (305) 269 7500

(fax) (305) 269 7599

##### **Taiwan:**

(tel) 0800 047 866

(fax) 0800 286 331

##### **Other Asia Pacific Countries:**

(tel) (65) 6375 8100

(fax) (65) 6836 0252

Email: tm\_asia@agilent.com

#### **Online Assistance:**

**[www.agilent.com/find/assist](http://www.agilent.com/find/assist)**

Product specifications and descriptions in this document subject to change without notice.

© Agilent Technologies, Inc. 2002

Printed in USA, December 17, 2002

5980-1284E



**Agilent Technologies**